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Game and Parks Commission

Fisheries Division

Pallid Sturgeon Population Assessment Program 2003

Annual Report, Segment 9

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Performance Report

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Abstract

The Nebraska Game and Parks Commission is participating with the U.S. Army Corps of Engineers in the Long Term Pallid Sturgeon Assessment. NGPC sampled the reach from the Platte River (River Mile 595.0) to the Kansas River (R.M. 367.5).

Winter gill netting season began in March 2003, when ice flows subsided. In 100 net nights, over 2,400 sturgeon where sampled. Two were pallid sturgeon and the remainder were shovelnose sturgeon. Both pallid sturgeon were sampled from inside bend, wing dike tip pools. The first was sampled on 24 March at Nebraska Bend. This pallid had been previously PIT tagged and had a fork length of 561 mm and weighed 580 grams. It was spawned in 1999 and stocked on 25 April 2002 at Booneville, Missouri (R.M. 195.1). Prior to stocking, it had a fork length of 570 mm and weighed 390 grams. The second pallid sturgeon was collected on 26 March on Upper Barney Bend. This fish was checked for PIT and coded wire tags, but was not tagged. It had a fork length of 1,080 mm and weighed 4,250 grams.

After winter gill netting was completed, we started the sturgeon sampling season. Sampling gears included drifted trammel nets, hoop nets, two-meter beam trawls and 4.9 m (16 ft.) otter trawls. While otter trawling on 29 May, a pallid sturgeon was sampled on Calumet Bartlett Bend at the toe of the upper revetment which was lined with limestone. The sturgeon had a fork length of 894 mm and weighed 2,750 grams, and had not been previously tagged. Sampling continued until 30 June, when the community sampling season began. This season utilized the same gears as the sturgeon sampling season with addition of bag seines and mini-fyke nets. No pallid sturgeon were collected during the community sampling season. The 2003 season concluded when the water temperature drop below 12.7^{o}C.

Keywords: Missouri River, pallid sturgeon, shovelnose sturgeon, speckled chub, sturgeon chub, sicklefin chub, sand shiner, plains minnow, bigmouth buffalo, blue sucker, sauger, gill net, otter trawl, beam trawl, trammel net, hoop net, seine, mini-fyke net, set line, macrohabitat, and mesohabitat.

Steffensen, K.D. and G.E. Mestl. 2004. Pallid Sturgeon Population Assessment Program 2003. Annual Report, Segment 9, Nebraska Game and Parks Commission, Lincoln, Nebraska.

Introduction

Due to the decline in the population of the pallid sturgeon (*Scaphirhychus albus*), it was federally listed as endangered in 1990. Being native to the Missouri and Mississippi River System, the pallid sturgeon has evolved with and adapted to large river conditions. Modification of the pallid sturgeon's habitat by human activities has blocked fish movement, destroyed or altered spawning areas, reduced food sources or ability to obtain food, altered water temperatures, reduced turbidity, and changed hydrograph (USFWS 1993). In response to obvious declines in population and lack of recruitment, the United States Fish and Wildlife Service developed the Biological Opinion on the Operation of the Missouri River Main System Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (Bi-Op) in 2000. This report made recommendations to the U.S. Army Corps of Engineers (USACE) to modify the Missouri River flow to a more natural flow regime, to increase pallid sturgeon propagation and augmentation efforts, and to assist and provide funding for a basin-wide pallid sturgeon assessment. In response to the Bi-Op, the USACE formed the Pallid Sturgeon Assessment Team with representatives from federal and state agencies and universities. The team developed standard operating procedures (SOP) for long-term pallid sturgeon and associated fish community assessment for the Missouri River. This included creating standard habitat definitions, selecting and describing standard sampling gears thought to be suitable for use in the Missouri River, creating sampling protocols for sampling fish and habitat parameters, developing a standard data sheets, and reporting procedures.

Objectives

The objectives of this study are to:

Objective #1: Document current and long-term trends in pallid sturgeon population abundance, distribution and habitat usage throughout the Missouri River System.

Objective #2: Document survival, growth, and habitat use of stocked pallid sturgeon in the Missouri River System.

Objective #3: Document pallid sturgeon reproduction and recruitment in the Missouri River System.

Objective #4: Document current and long-term trends in native Missouri River fish species abundance, distribution, and habitat usage, with emphasis on the warm water benthic fish community.

Study Area

The project area includes the Missouri River from Fort Peck Dam (R.M. 1771.5) to the confluence of the Missouri and Mississippi Rivers (R.M. 0.0) and the lower reach of the Kansas River. The Biological Opinion divided the Missouri River into river and reservoir reaches and categorized these areas as either high, moderate or high priority management areas. The areas which were given high priority designation by the Bi-Op for the pallid sturgeon include Segment Area 2 (Fort Peck Dam, Montana to the headwaters of Lake Sakakawea, North Dakota), Area 8 (Fort Randall Dam, South Dakota to the mouth of the Niobrara River, Nebraska) , and Areas 10 through 15 (Gavins Point Dam, Nebraska/ South Dakota to the mouth of the Missouri River) (Table 1). Moderate priority action areas include: Area 6, (Oahe Dam, South Dakota to Big Bend Dam, South Dakota) and Area 16 (Confluence of the Republican and Smoky Hills River, Kansas to the mouth of the Kansas River, Kansas). Only areas designated as high priority for pallid sturgeon were sampled.

The Pallid Sturgeon Population Assessment Team identified 14 river segments based on changes in physical attributes such as degrading or aggrading stream bed, flow fluctuation, natural hydrograph, stream gradient, geology, water temperature, turdibity, substrate, discrete habitat changes (tributary or tributary influence) and modification (presence of restoration projects) (Drobish 2003). There are areas sampled that are not designated however, the Kansas River from Johnson County Weir to the mouth and Area 9 (Niobrara River, Nebraska to the headwaters of Lewis and Clark Lake Nebraksa/South Dakota). This area was sampled because telemetry studies have shown that juvenile pallid sturgeon have used these transitional areas.

The Nebraska Game and Parks Commission sampled segment 9 from the confluence of the Platte and Missouri Rivers at Plattsmouth, Nebraska, downstream to the mouth of the Kansas River at Kansas City, Missouri. This 227.5 mile long segment consists of 80 named bends (Table 2).

Table 1. Project areas for pallid sturgeon sampling on the Missouri River by segments from Fort Peck Dam to the confluence with the Mississippi River.

Assessment Team Segments	Bi-Op Segments	River Segments	River Miles
1	2	Fort Peck Dam to the Milk River	1771.5 – 1760.0
2		Milk River to Wolf Point	1760.0 – 1701.0
3		Wolf Point to the confluence with the Yellowstone River	1701.0 – 1582.0
4		Confluence of the Yellowstone River through the headwaters of Lake Sakakwea	1582.0 – 1568.0
5	8	Fort Randall Dam to the confluence with the Niobrara River	880.0 – 845.0
6	9	Confluence of the Niobrara River through the headwaters of Lewis and Clark Lake	845.0 – 825.0
7	10	Gavins Point Dam to Lower Ponca Bend	811.0 – 750.0
8	11 & 12	Lower Ponca Bend to the confluence of the Platte River	750.0 – 595.0
9	13	Confluence of the Platte River to the confluence of the Kansas River	595.0 – 367.5
10	14	Confluence of the Kansas River to the confluence of the Grand River	367.5 – 250.0
11	Section of 16	Kansas River upstream to Johnson County Weir	
12	14	Confluence of the Grand River to Glasgow	250.0 – 220.0
13		Glasgow to the confluence of the Osage River	220.0 – 130.0
14	15	Confluence of the Osage River to the mouth of the Missouri River	130.0 – 0.0

Table 2. Bend list for segment 9 (Platte River to the Kansas River of the Missouri River).

Bend Number	Bend Name	River Mile
1	Upper Plattsmouth Bend	595.0 - 591.7
2	Lower Plattsmouth Bend	591.7 - 589.0
3	Tobacco Bend	589.0 - 586.0
4	Rock Bluff Bend	586.0 - 582.7
5	Calumet Bartlett Bend	582.7 - 578.8
6	Pin Hook Bend	578.8 - 576.4
7	Van Horns Bend	576.4 - 574.6
8	Upper Civil Bend	574.6 - 572.5
9	Lower Civil Bend	572.5 - 569.8
10	Upper Copeland Bend	569.8 - 565.0
11	Lower Copeland Bend	565.0 - 563.0
12	Nebraska Bend	563.0 - 559.7
13	Frazers Bend	559.7 - 557.0
14	Otoe Bend	557.0 - 554.9
15	Upper Hamburg Bend	554.9 - 553.0
16	Lower Hamburg Bend	553.0 - 550.4
17	Upper Barney Bend	550.4 - 549.6
18	Lower Barney Bend	549.6 - 546.2
19	Upper Kansas Bend	546.2 - 544.7
20	Lower Kansas Bend	544.7 - 543.3
21	Nishnabotna Bend	543.3 - 542.0
22	Peru Bend	542.0 - 539.8
23	Upper Sonara Bend	539.8 - 536.9
24	Lower Sonara Bend	536.9 - 534.7
25	Upper Brownville Bend	534.7 - 533.5
26	Lower Brownville Bend	533.5 - 531.7

Bend Number	Bend Name	River Mile
27	Langdon Bend	531.7 - 529.0
28	Aspinwall Bend	529.0 - 526.0
29	Upper Morgan Bend	526.0 - 523.9
Table 2. Continued 30	Lower Morgan Bend	523.9 - 522.4
31	Lincoln Bend	522.4 - 520.5
32	Upper Deroin Bend	520.5 - 518.4
33	Lower Deroin Bend	518.4 - 517.6
34	Indian Cave Bend	517.6 - 516.0
35	Hemmies Bend	516.0 - 512.5
36	Upper Cottier Bend	512.5 - 508.4
37	Lower Cottier Bend	508.4 - 506.9
38	Upper Arago Bend	506.9 - 504.5
39	Lower Arago Bend	504.5 - 501.8
40	Upper Rush Bottom Bend	501.8 - 500.3
41	Lower Rush Bottom Bend	500.3 - 498.6
42	Rulo Bend	498.6 - 494.4
43	Nemaha Bends	494.4 - 491.2
44	Squaw Bend	491.2 - 489.8
45	White Cloud Bends	489.9 - 486.0
46	Iowa Point Bend	486.0 - 483.4
47	Tarkio Bend	483.4 - 480.9
48	Wolf Creek Bend	480.9 - 477.7
49	Forbes Bends	477.7 - 472.5
50	Mt. Vernon Bends	472.5 - 469.0
51	Charleston Bend	469.0 - 467.1
52	Dallas Bends	467.1 - 463.0
53	Mill Creek Bend	463.0 - 458.8

Bend Number	Bend Name	River Mile
54	Burr Oak Bend	458.8 - 454.9
55	Amazonia Bend	454.9 - 451.7
56	Bon Ton Bend	451.7 - 449.4
57	St. Joseph Bend	449.4 - 443.0
58	Palermo Bend	443.0 - 438.1
59	Kenmoor Bend	438.1 - 435.2
Table 2. Continued 60	Geary Bends	435.2 - 431.5
61	Doniphan Bend	431.5 - 429.1
62	Rushville Bend	429.1 - 425.3
63	Atchison Bend	425.3 - 417.9
64	Bean Lake Bend	417.9 - 415.8
65	Oak Mills Bend	415.8 - 412.2
66	Upper Iatan Bend	412.2 - 410.0
67	Middle Iatan Bend	410.0 - 408.4
68	Lower Iatan Bend	408.4 - 407.0
69	Kickapoo Bend	407.0 - 404.2
70	Weston Bend	404.2 - 400.3
71	Fort Bend	400.3 - 398.9
72	Leavenworth Reach	398.9 - 397.1
73	Leavenworth Bend	397.1 - 392.4
74	Delaware Bend	392.4 - 388.7
75	Pope Bend	388.7 - 385.0
76	Weavers Bend	385.0 - 383.2
77	Pomeroy Bend	383.2 - 378.5
78	Parkville Bend	378.5 - 375.4
79	Quindaro Bend	375.4 - 371.9

Bend Number	Bend Name	River Mile
80	Kaw Bend	371.9 - 368.8

Methods

Gear and methods were developed by the Pallid Sturgeon Assessment Team and described in Long-term Pallid Sturgeon and Associated Fish Community Assessment for the Missouri River and Standardized Guidelines for Sampling and Data Collection, (Draft), (Drobish 2003). Collection methods, including the handling of pallid sturgeon, conformed with methods described in Biological Procedures and Protocol for Collecting, Tagging, Sampling, Holding, Culture, Transporting, and Data Recording for Researchers and Managers Handling Pallid Sturgeon (Krentz 2001). All meristic measurements were recorded when a pallid sturgeon was sampled, along with pictures, habitat parameters, and all tagging information. If the pallid sturgeon had not been previously PIT tagged, a PIT tag was placed in accordance with the protocols. All other species collected were measured to nearest millimeter and weighed to nearest gram and then released. An exception to this was during the community sampling season, when seine and mini-fyke net samples were preserved in 10% formalin and brought back to the lab for identification. Seine and mini-fyke net were identified to species, stored in 70% alcohol and labeled by species by sample. Habitat samples were collected at the site of every pallid sturgeon capture, and were collected at 25% of the remaining sampling sites. The predetermined parameters for habitat sampling were GPS coordinates (latitude and longitude in decimal degrees), water depth (m), water velocity ((mps) at bottom, 0.2, and 0.8 of water column), water temperature (^{o}C), turbidity (NTU), and sediment profile (based on percent of gravel, sand and silt).

Sampling Seasons

The 2003 sampling year was broken into three seasons: winter, sturgeon, and community. Each sampling season uses gear types specific for that season. The winter sampling season is defined by water temperature below 12.7^{o}C (55^{o}F). Only experimental gill nets were used during the winter sampling season. During the winter each segment was divided into ten mile long reaches (Table 3). Three ten mile reaches were randomly selected and two ten mile reaches were non-randomly selected.. The sturgeon (spring) sampling season started after water temperature exceeded 12.7^{o}C through 30 June. Five gear types were used during the sturgeon sampling season: otter trawls, beam trawls, trammel nets, hoop nets, and set lines. Sampling occurred on the bend level, eight bends were randomly selected and two bends were non-randomly selected. Community sampling season began on 1 July and continued until the water temperatures dropped below 12.7^{o}C. Six gear types were used during the community season sampling: otter trawls, trammel nets, hoop nets, seines, mini-fyke nets, and set lines. Sampling occurred on

the bend level, eight bends were randomly selected and two bends were non-randomly selected.

Habitat Classifications

The Pallid Sturgeon Assessment Team developed a standard set of habitat classifications for the Missouri River. Each river bend contains thee continuous macrohabitats, main channel outside bend, main channel inside bend, and main channel cross over. Additional discrete macrohabitats have been identified that are not present in every bend. These include: large tributaries, small tributaries, tributary confluence, large secondary connected channel, small secondary connected channel, and non-connected secondary channels. Mesohabitats have been established and defined to describe macrohabitats and microhabitas may be used to further describe mesohabitats including identification of unique structural modifications. Mesohabitat classifications includes: bars, pools, channel boarder, thalweg, and island tip. Bars are a sand bar or shallow bankline mesohabitats were the terrestrial/aquatic interface area of deposited sediment where water depth is less than 1.2 m (Draft), Drobish 2003). Pools are areas immediately downstream for sandbars, dikes, snag-piles or other obstructions that have formed a scour hole greater than 1.2 m. Channel boarder lies along a bankline or a sandbar area between the thalweg and the 1.2 m depth interval. Thalweg is the main channel between the channel boarders and is the area of maximum depth. Island tip is the area immediately downstream of a bar or inland where two channels converge and water depth is greater than 1.2 m.

Gear

Gill Net

The standard gill net was a four panel experimental gill net 30.5 m (100 ft.) long with a height of 2.4 m (8 ft.). The standard gill net had four 7.6 m (25 ft.) panels of multifilament of 38.1 mm (1.5") (Panel 1), 50.8 mm (2.0") (Panel 2), 76.2 mm (3.0") (Panel 3), and 101.6 mm (4.0") (Panel 4) bar mesh. Twine size was #104 for 38.1 mm and 50.8 mm panels and #139 for 76.2 mm and 101.6 mm panels. The float line was a braided poly-foam core of 13 mm (1/2") diameter and the lead line was 7.1 mm (9/32") (22.7 kg./600 ft.). A double length gill net (61 m or 200 ft.) could be used when needed to sample a particular location and consisted of two standard gill nets attached together but counted as twice the effort. Panel numbering continued for 61 m nets, so the second 38.1 mm mesh is panel 5, the second 50.8 mm mesh is panel 6, the second 76.3 mm mesh is panel 7 and the second 101.6 mm mesh is panel 8. Gill nets were set on inside bends, outside bends, and tributary confluences in pools parallel to the current with lead

end (38.1 mm or 101.6 mm mesh) selected randomly. A hoop net hook was used to secure the net to the wing dike, by using a 25 ft. (7.6 m) lead rope then tied to the hoop net hook with a cement block attached to the opposite end. The gill net lead line was tied to the block. The down river end of the net was tied to a cement block. A rope with a float was tied to the cement block for retrieval.

Otter Trawl

The standard otter trawl had a width of 4.9 m (16 ft.), height of 0.9 m (3 ft.), and a length of 7.6 m (25 ft.). The trawl had an inner mesh (6.35 mm (1/4") bar, #18 polyethylene twine) and outer mesh (38.1 mm (1.5") bar, #9 polyethylene twine), with a cod-end opening of 406.4 mm (16"). The inner mesh had a 50.8 mm (2") sleeve sewn along the top section for the insertion of a hoop to keep the net open, allowing fish to reach the cod end of the net. Trawl doors made from 19.1 mm (3/4") marine plywood, measuring 762 mm (30") x 381 mm (15"), were used to keep the trawl deployed on the river bottom. A 7.9 m (26 ft.) tickler chain (3.2 mm (0.125") galvanized) was attached to the back corner of the trawl doors and ran approximately three feet in front of the footrope. The tickler chain provided some additional protection for the lower mouth of the otter trawl and also aided in dragging of river bed. Trawl nets were fished downstream, with length of trawl depending on the macrohabitat and mesohabitat being sampled. Trawls had to be minimum of 75 m (246 ft.) and a maximum of 300 m (984 ft.).

Beam Trawl

The standard beam trawl was 2.0 m (6.4 ft.) wide x 0.5 m (1.6 ft.) high x 457.2 mm (18") deep. The trawl was composed of an outer mesh of #15 twisted nylon twine bar netting with a mesh size of 15.9 mm (5/8"), and an inner mesh of 3.2 mm (1/8") delta netting. A footrope chain was attached to the lower corners of the beam trawl frame to ensure the net trawled the river bottom. The net was attached to a steel frame, composed of two triangular skids connected by a 2 m (6.4 ft.) piece of square tubing. The beam trawl was used in the thalweg during the sturgeon sampling season.

Trammel Net

The standard trammel net had a length of 38.1m (125 ft.), with an inner mesh 2.4 m (8 ft.) deep and two outer walls, 1.8 m (6 ft.) deep. The inner mesh was composed of #139 multifilament twine with a bar mesh size of

25.4 mm (1.0"). The outer walls were of #9 multifilament twine with a bar mesh size of 203.2 mm (8.0"). The float line was a 12.7 mm (1/2") foam core and the lead line was a 22.7 kg (50 lb.). Trammel nets were drifted a maximum of 300 m and a minimum of 75 m and used on channel borders.

Hoop Net

The standard hoop nets were made of #15 twine with 38.1 mm (1.5") bar mesh, and were supported by seven tapered fiberglass hoops approximately 1.2 m (4 ft.) in diameter. The net had two inner throats, on the 2nd and 4th hoops. Hoop net hooks were used to secure the net to the river bottom, a 7.6 m (25 ft.) lead rope was tied to the hoop net hook and to the back end of the hoop net. A rope with a float was attached to the mouth of the hoop net for retrieval. Hoop nets were placed parallel to the current in pools and channel borders associated with steeps.

Seine

The standard seine had 9.1 m (30 ft.) long by 1.8 m (6 ft.) high with a bag that measured 1.8 m x 1.8 m x 1.8 m. The seine had 6.4 mm (1/4") ace mesh with a 29.5 kg (65 lb.) lead core line. Seines were pulled upstream in a quarter arc, half arc, or rectangular fashion. The area sample (length and width) was measured to the nearest tenth of a meter using a 100 m (328 ft.) field tape. Seines were used on bars. Seines were used during community sampling season.

Mini-Fyke Net

The standard mini-fyke net had two rectangular frames (1.2 m (4.0 ft.) x 0.6 m (2.0 ft.)) and two hoops (0.6 m (2.0 ft.)) made of oil tempered spring steel. A 4.5 m (15 ft.) x 0.6 m (2.0 ft.) lead was connected to the second rectangular frame. The mini-fyke net had 3 mm (1/8") ace mesh with a 29.5 kg (65lb.) lead core line. Mini-fyke nets were used during the community sampling season on bars.

Set Line

The standard set lines were composed of an anchor, nylon twine, two hooks, and a float line. This consisted of an anchor with two lines attached. The first had a float attached for retrieval, the second had two hooks. The hooks were composed of one 10/0 and one 12/0 hook per set. Each hook was baited with nightcrawlers. Set lines were used in all types of habitats.

Table 3. Ten-mile sampling reaches defined for the winter gill net season (March – April) 2003 for segment 9 of the Missouri River.

River Segment	River Reach	River Miles
1	Platte River Reach	595.0 – 585.0
2	Goose Island Reach	585.0 – 575.0
3	Weeping Water Creek Reach	575.0 – 565.0
4	Nebraska City Reach	565.0 – 555.0
5	Hamburg Reach	555.0 – 545.0
6	Nishnabotna River Reach	545.0 – 535.0
7	Langdon Reach	535.0 – 525.0
8	Indian Cave Reach	525.0 – 515.0
9	Thurnau Reach	515.0 – 505.0
10	Rulo Reach	505.0 – 495.0
11	Big Nemaha River Reach	495.0 – 485.0
12	Iowa Point Reach	485.0 – 475.0
13	Forbes Reach	475.0 – 465.0
14	Nodaway Reach	465.0 – 455.0
15	Upper St. Joseph Reach	455.0 – 445.0
16	Lower St. Joseph Reach	445.0 – 435.0
17	Doniphan Reach	435.0 – 425.0
18	Atchison Reach	425.0 – 415.0
19	Harpst Island Reach	415.0 – 405.0
20	Leavenworth Reach	405.0 – 395.0
21	Stigers Island Reach	395.0 – 385.0
22	Pomeroy Reach	385.0 – 375.0
23	Kansas City Reach	375.0 – 367.5

Results

Objectives #1 - #3

Objective #1: Document current and long-term trends in pallid sturgeon population abundance, distribution and habitat usage throughout the Missouri River System.

Objective #2: Document survival, growth, and habitat use of stocked pallid sturgeon in the Missouri River System.

Objective #3: Document pallid sturgeon reproduction and recruitment in the Missouri River System.

During 2003, Nebraska Game and Parks Commission sampled three pallid sturgeon. The first was sampled during the winter sampling season on 24 March with a static gill net on Nebraska Bend (RM 562.5) (Table 4). It had a fork length of 561mm and weighed 580 grams. The gill net was set on an inside bend pool off of the tip of a wing dike. The pallid sturgeon was sampled in panel 1(1.5" mesh) which was the first panel from the wing dike. The sampling location had a depth of 1.6 m and a bottom velocity of 0.14 mps. It had been previously PIT tagged and was stocking at Booneville, MO (RM 195.1) on April 25, 2002 (Table 5). The group stocking fork length was 570 mm and group stocking weight was 390 g.

The next pallid sturgeon was sampled during the winter sampling season on 26 March with a static gill net on Upper Barney Bend (RM 549.5) (Table 4). It had a fork length of 1080 mm and weighed 4250 grams. The gill net was set on an inside bend pool off of the tip of a wing dike. The pallid sturgeon was sampled in panel 2 (2.0" mesh) which was the second panel from the end of the net. The sampling location had a depth of 2.5 m and a bottom velocity of 0.06 mps. It had not been previously tagged and was assumed to be wild.

The final pallid sturgeon was sampled during the sturgeon sampling season on 29 May with a 16 ft. otter trawl on Bartlett Bend also known as Goose Island (RM 582.5) (Table 4). It had a fork length of 894 mm and weighed of 2750 grams. The otter trawl was pulled on the outside bend in the thalweg along several revetment scallops. The sampling location had a depth of 6.1 m and a bottom velocity of 1.65 mps. It had not been previously tagged and was assumed to be wild.

During the winter gill netting season, one hundred samples were completed with 200 ft gill nets, totaling 200 net nights of effort. Only 27% of the samples occurred when bottom velocities were less than 0.2 mps (Figure 1). However, both of the pallid sturgeon were sampled in areas where bottom velocities were less than 0.2 mps. Of the one hundred samples, 46% occurred in depths of less then 3.0 m, and both pallid sturgeon were sampled in 3.0 m

or less (Figure 2).

During the sturgeon sampling season, ninety-seven samples were completed with a 16 ft. otter trawl. Less than 5% of the samples occurred when bottom velocity measurements were greater than 1.6 mps (Figure 3). However, the only pallid sturgeon sampled during this sampling season was sampled in an area with 1.65 mps bottom velocity. Almost one-quarter of the samples occurred in depths greater than 6 m and all outside bend thalweg samples occurred in depths greater than 4.2 m (Figure 4). The pallid sturgeon was collected in 6.1 m of water, which was the deepest area on Bartlett Bend.

Over 900 net samples were collected from the Missouri River between the Platte River and the Kansas River during 2003. A total of 3,233 river sturgeon were collected. This results in a pallid sturgeon to river sturgeon catch ratio of 1:1078 (Table 6). Two wild pallid sturgeon and one hatchery recaptured pallid sturgeon results in catch ratios of 1:1617 and 1:3233 respectively. During 2003, no sturgeon were identified as pallid sturgeon x shovelnose sturgeon hybrids.

Pallid sturgeon were stocked between 16 July and 2 December 2003. 15,155 pallid sturgeon were stocked between Fort Randall Dam and the confluence with the Mississippi (Table 7). Six hundred and one pallid sturgeon were stocked between Fort Randall Dam and the headwaters of Lewis and Clark Lake. The remaining pallid sturgeon were stocked below Gavins Point Dam. All of the 9,842 pallid sturgeon stocked from the 2002 year class were PIT tagged, and 1,535 were also tagged with elastomere. The mean fork length at stocking ranged from 241 mm to 291 mm. During November and December 2003, 5,313 pallid sturgeon were stocked from the 2003 year class. Due to the small stocking size, these pallid sturgeon were tagged with coded wire tags and elastomere. The pallid sturgeon stocked during 2003 were produced at the Garrison Dam National Fish Hatchery, Gavins Point National Fish Hatchery, and Neosho National Fish Hatchery.

No larval *Scaphirynchus* species were sampled during 2003. However, in late September and early October five young of the year shovelnose sturgeon (FL < 150 mm) were collected while otter trawling.

Table 4. Pallid sturgeon sampled from segment 9 (March – October) of the Missouri River during 2003.

Date	3/24/2003	3/26/2003	5/29/2003
Location	Nebraska Bend	Upper Barney Bend	Bartlett Bend
River Mile	562.5	549.5	582.5
Life Stage	Juvenile	Adult	Adult
Reared	Hatchery	Wild	Wild
Gear	Gill Net (Panel 1 - 8)	Gill Net (Panel 8 - 1)	16 ft. Otter Trawl
Sampling Season	Winter	Winter	Sturgeon
Macrohabitat	Inside Bend	Inside Bend	Outside Bend
Mesohabitat	Pool	Pool	Thalweg
Microhabitat	Wing Dike Tip	Wing Dike Tip	Revetment Scallop
PIT Tag	424E3D6831	115713640A	412C42096E
Fork Length	561 mm	1080 mm	894 mm
Weight	580 g	4250 g	2750 g
Depth	1.6 m	2.8 m	6.1 m
Bottom Velocity	0.14 mps	0.06 mps	1.65 mps
Temperature	9^{o}C	10^{o}C	20^{o}C
Substrate	97% Sand 3% Gravel	87% Sand 13% Silt	75% Sand 25% Gravel
Turbidity	125 NTU	137 NTU	84 NTU

Table 5. Recapture pallid sturgeon sampled from segment 9 (March – October) of the Missouri River during the 2003.

Recapture Information					Stocking Information					
Date	Location	River Mile	Fork Length (mm)	Weight (g)	Date	Location	River Mile	Fork Length (mm)	Weight (g)	PIT Tag Number
3/24/2003	Nebraska Bend	562.5	561	580	4/25/2002	Booneville, MO	195.1	570	390	424E3D6831

Figure 1. Percent of pallid sturgeon collected versus percent of bottom velocity availability during 2003 while winter gill netting.

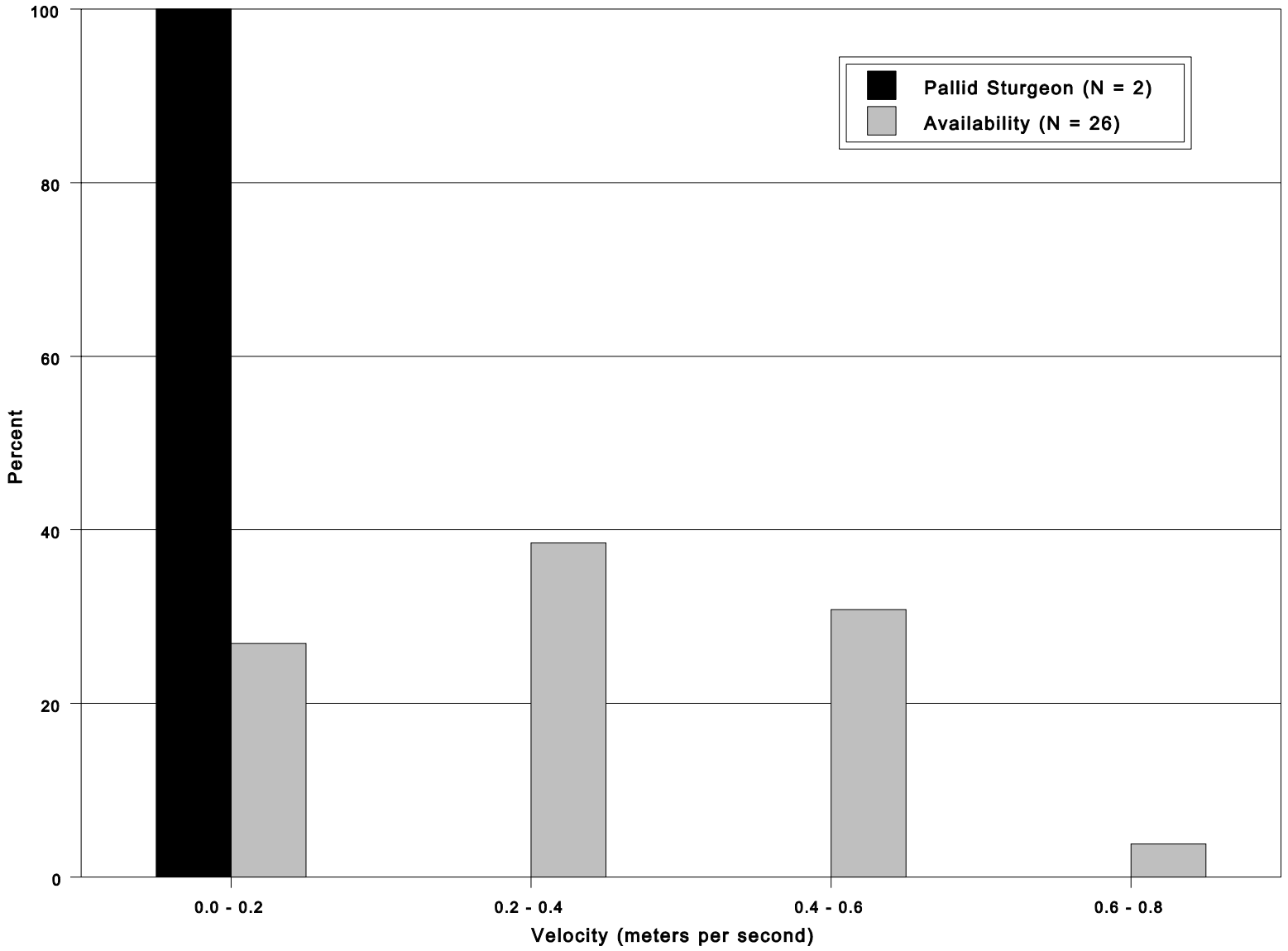

Figure 2. Percent of pallid sturgeon collected versus percent of depth availability during 2003 while winter gill netting.

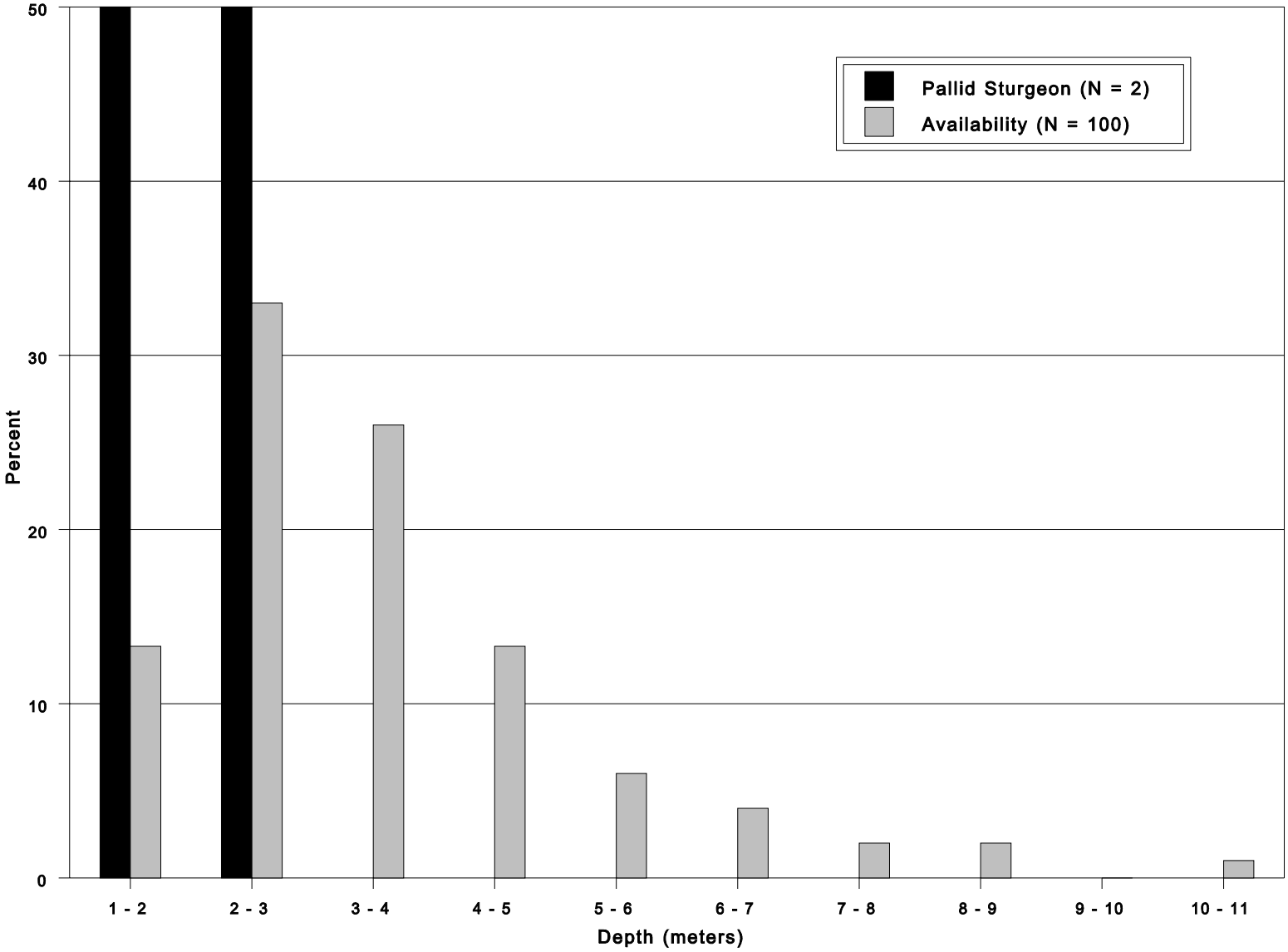

Figure 3. Percent of pallid sturgeon collected versus percent of bottom velocity availability during 2003 while otter trawling during the sturgeon sampling season.

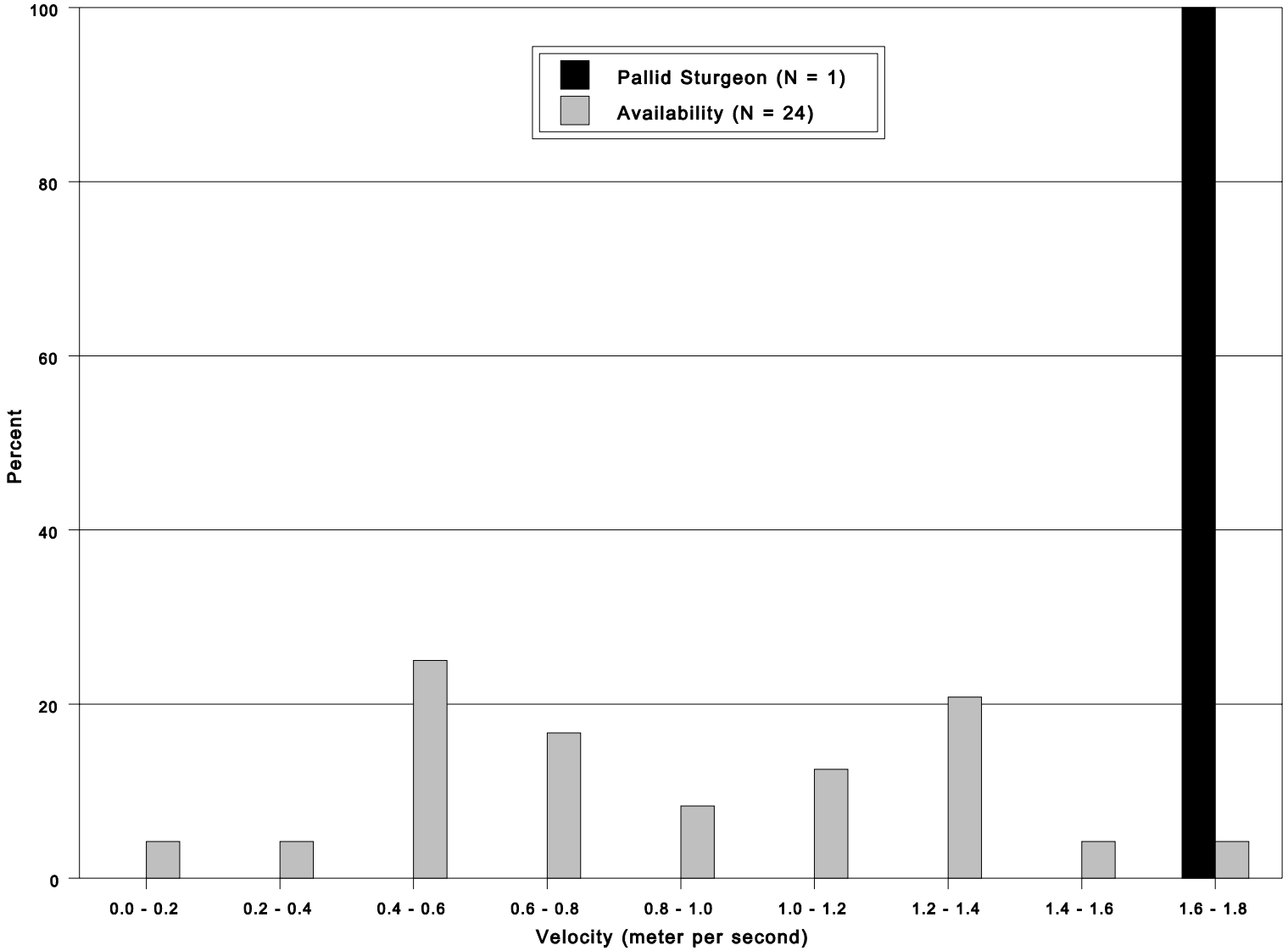

Figure 4. Percent of pallid sturgeon collected versus percent of depth availability during 2003 while otter trawling during the sturgeon sampling season.

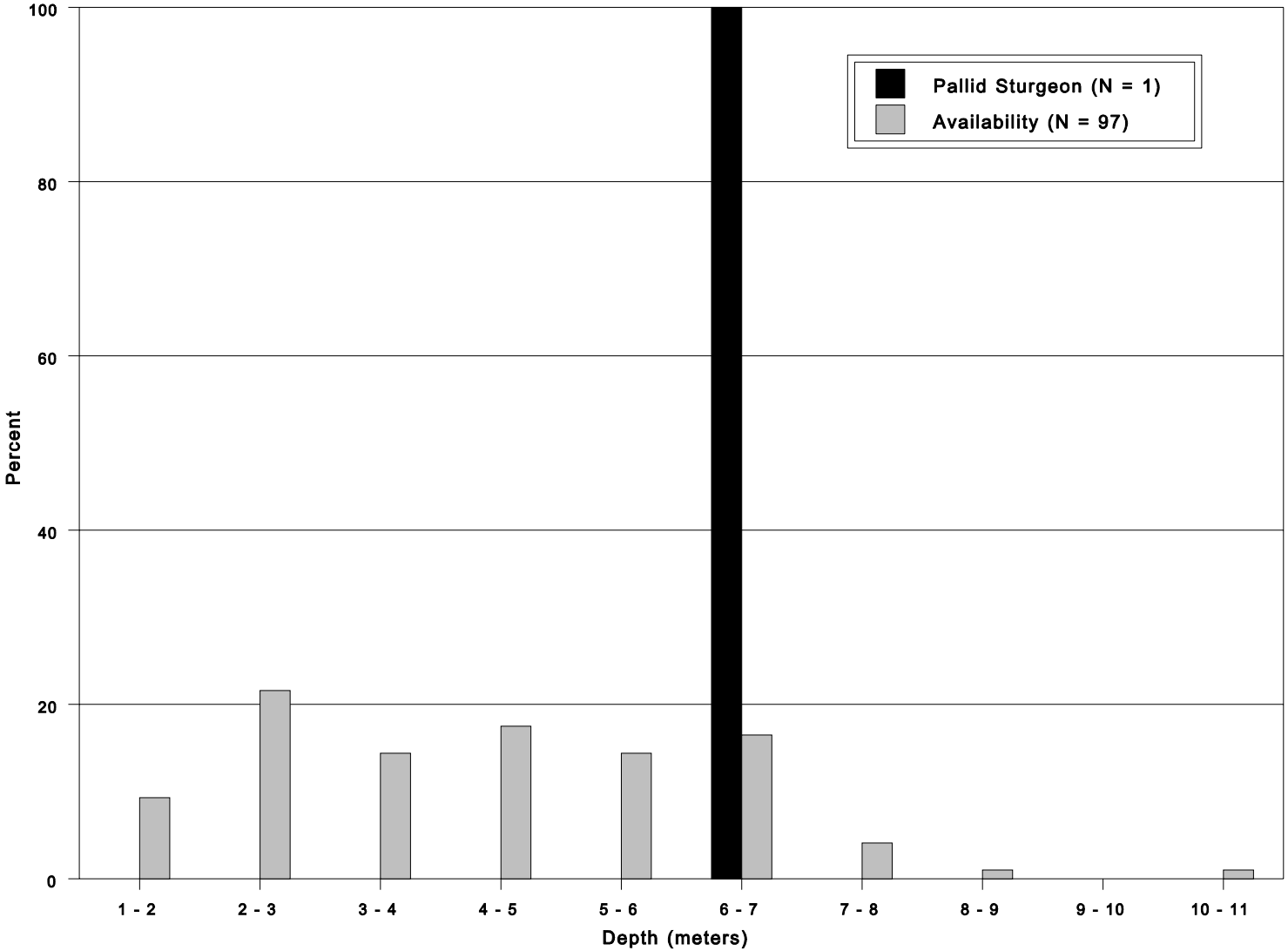

Table 6. Ratio of pallid sturgeon to hybrids, pallid sturgeon to river sturgeon, and wild vs. hatchery reared pallid sturgeon sampled from segment 9 (March – October) of the Missouri River during 2003.

Ratio of pallid sturgeon to hybrids		
Pallid Sturgeon	Pallid Sturgeon x Shovelnose Sturgeon	Ratio
3	0	3 : 0
Ratio of pallid sturgeon to river sturgeon		
Pallid Sturgeon	Pallid, Shovelnose, and Lake Sturgeon	Ratio
3	3,233	1 : 1078
Ratio of wild pallid sturgeon to hatchery reared pallid sturgeon		
Wild Pallid Sturgeon	Hatchery Reared Pallid Sturgeon	Ratio
2	1	2 : 1

Table 7. Stocking locations of pallid sturgeon on the Missouri River from Sunshine Bottoms, NE to Booneville, MO during 2003.

Year Class	Date	Stocking Location	River Mile	Number	Average Length	Average Weight	Type of Tags	Hatchery
2002	7/16/2003	Mulberry Bend	776.9	1936	281 mm	74 g	PIT	Garrison Dam
	7/16/2003	Bellevue	601.4	1938	278 mm	76 g	PIT	Garrison Dam
	7/16/2003	Booneville	195.1	1440	277 mm	NA	PIT	Garrison Dam
	7/26/2003	Sunshine Bottoms	868.1	301	241 mm	57 g	PIT	Gavins Point
	7/26/2003	Standing Bear Bridge	842.8	300	248 mm	62 g	PIT	Gavins Point
	9/4/2003	Mulberry Bend	776.9	500	277 mm	94 g	PIT and Elastomere	Gavins Point
	9/4/2003	Bellevue	601.4	500	283 mm	93 g	PIT and Elastomere	Gavins Point
	9/4/2003	Booneville	195.1	535	291 mm	100 g	PIT and Elastomere	Gavins Point
	10/6/2003	Mulberry Bend	776.9	133	263 mm	NA	PIT	Garrison Dam
	10/24/2003	Mulberry Bend	776.9	666	258 mm	69 g	PIT	Neosho
	10/24/2003	Bellevue	601.4	717	267 mm	71 g	PIT	Neosho
	10/24/2003	Booneville	195.1	876	261 mm	72 g	PIT	Neosho
2003	11/3/2003	Mulberry Bend	776.9	1763	NA	24 g	Coded Wire and Elastomere	Garrison Dam
	12/2/2003	Bellevue	601.4	1781	NA	22 g	Coded Wire and Elastomere	Garrison Dam
	12/2/2003	Booneville	195.1	1769	NA	22 g	Coded Wire and Elastomere	Garrison Dam

Objective #4

Objective #4: Document current and long-term trends in native Missouri River fish species abundance, distribution, and habitat usage, with emphasis on the warm water benthic fish community.

Winter Sampling Season

The winter sampling season is defined by water temperature below 12.7°C, in which gill nets were used exclusively. A total of 2,988 fish, representing 26 species were captured in 200 gill net nights, with a total catch per unit effort (CPUE) of 14.94 fish per net night (Table 8). Shovelnose sturgeon (*Scaphirhynchus platorynchus*) were the most frequently captured species with a CPUE of 11.98, while goldeye (*Hiodon alosoides*) were second with a CPUE of 1.20. Gill nets were set with either panel one first (GN18) or panel eight first (GN81). GN18 sets captured 1,751 fish in 104 net nights for a CPUE of 16.84 fish per net. GN81 sets captured 1,237 fish in 96 net nights for a CPUE of 12.89 fish per net. Two pallid sturgeon (GN18 and GN 81) and one lake sturgeon (*Acipenser fulvescens*) (GN81) were captured in gill nets.

During the winter sampling season, pools were the only mesohabitat sampled. Confluence pools had the highest catch rate of sampled areas, with an mean CPUE of 19.00 fish per net, followed by inside bend pools (mean CPUE = 15.06 fish per net) and outside bend pools (mean CPUE = 7.00 fish per net) (Table 8). Shovelnose sturgeon and blue suckers (*Cycleptus elongatus*) were captured more abundantly in gill nets than other target species. Both pallid sturgeon were sampled in water depths of less than 3 m and water velocities of less than 0.3 mps (Table 9). Based on available habitat, shovelnose sturgeon were randomly distributed by depth ($x^2 = 1.024$, df = 8, P = 0.998) and bottom velocity ($x^2 = 6.296$, df = 3, P = 0.098). Blue suckers were not distributed randomly by depth ($x^2 = 18.380$, df = 8, P = 0.019) but were selecting depths from 3 to 4 m and avoiding water deeper than 5 m.

Sturgeon Sampling Season

The sturgeon sampling season started after the water temperature exceeded 12.7°C through 30 June.

Otter Trawl

A total of 727 fish representing 22 species were captured in 20,380 meters of trawling, with a CPUE of 3.57 fish per 100 m trawled (Table 10). Channel catfish (*Ictalurus punctatus*) were the most frequently captured of with a CPUE of 1.57, while shovelnose sturgeon were second with a CPUE of 0.96. One pallid sturgeon was captured while otter trawling during the sturgeon sampling season.

Five macrohabitats were sampled during otter trawling: outside bends, inside bends, secondary connected channel-large, tributary mouth-large, and confluences. Tributary confluence had the highest rate of catch for macrohabitats (CPUE = 5.78), followed by inside bend with a CPUE of 5.69 (Table 10). Channel catish and shovelnose sturgeon were captured more abundantly in otter trawls during the sturgeon sampling seasons than other target species. Based on available depth, shovelnose sturgeon (x^2 = 19.006, df = 8, P = 0.015) and speckled chubs (x^2 = 78.339, df = 8, P = 0.001) were not distributed randomly (Table 11). Shovelnose sturgeon selected depths between 5 and 7 m, compared to speckled chubs that selected depths less than 2 m. Based on available bottom velocities, shovelnose sturgeon were randomly distributed (x^2 = 9.861, df = 8, P = 0.275).

Beam Trawl

Beam trawling was only used during the sturgeon sampling season. A total of 39 fish representing 10 species were captured in 7,358 meters of trawling, with a CPUE of 0.53 fish per 100 m trawled (Table 12). Shovelnose sturgeon were the most frequently captured species with a CPUE of 0.20, while speckled chubs (*Macrohybopsis aestivalis*) and sturgeon chubs (*Macrhybopsis gelida*) were second with a CPUE of 0.05.

Three macrohabitats were sampled during beam trawling: outside bends, secondary connected channel-large, and confluences. Confluences had the highest catch rate with a CPUE of 1.04, followed by outside bends with a CPUE of 0.50 (Table 12). Shovelnose sturgeon and *Macrohybopsis* species were captured more frequently in beam trawls than other target species. Relativity low numbers of target fish sampled does not allow for any conclusions based on depth and velocity preferences (Table 13).

Trammel Net

A total of 249 fish representing 15 species were captured in 10,196 meters of drifting trammel nets, with a CPUE of 2.44 fish per 100 m drifted (Table 14). Shovelnose sturgeon were the most frequently captured species with a CPUE of 1.57, while goldeye were second with a CPUE of 0.31.

Three macrohabitats were sampled during trammel netting: inside bends, secondary connected channel-large, and confluences. Channel borders were the only mesohabitat sampled. Secondary connected channel-large had the highest rate of catch, a CPUE of 6.37, followed by tributary confluences with a CPUE of 2.00 (Table 14). Based on available depth, shovelnose sturgeon (x^2 = 50.293, df = 3, P = 0.001) and blue suckers (x^2 = 10.606, df = 3, P = 0.014) were not distributed randomly (Tables 15). Shovelnose sturgeon selected depths less then 3 m, while

blue suckers selected depths between 2 and 4 m. Based on available bottom velocities, shovelnose sturgeon were not randomly distributed (x^2 = 34.050, df = 4, P = 0.001) and selected bottom velocities between 0.6 and 0.8 mps.

Hoop Net

A total of 345 fish representing 20 species were captured in 91 net nights, with a CPUE of 3.79 fish per net (Table 16). Shovelnose sturgeon were the most frequently captured species with a CPUE of 2.07, while channel catfish were second with a CPUE of 0.45.

Six macrohabitats were sampled during hoop netting: outside bends, inside bends, secondary connected channel-large, tributary mouth-small, tributary mouth-large and confluences. Pools and channel borders were the two mesohabitats sampled during hoop netting. Inside bends had the highest macrohabitat catch rate, with a CPUE of 4.38, followed by outside bends with a CPUE of 2.10 (Table 16). Based on available habitats, shovelnose sturgeon were not distributed randomly by depth (x^2 = 18.873, df = 6, P = 0.004) or bottom velocity (x^2 = 45.430, df = 4, P = 0.001) (Tables 17). Shovelnose sturgeon selected depths between 2 and 3 m and bottom velocities between 0.2 and 0.4 mps.

Set Line

A total of five fish representing three species were captured with set lines in 86 hook nights, with a CPUE of 0.06 fish per hook night (Table 18).

Three macrohabitats were sampled during set lining: outside bends, inside bends, and secondary connected channel-large. The secondary connected channel-large had the highest catch rate with a CPUE of 0.10, followed by inside bends with a CPUE of 0.07 (Table 18). Because a total of only three shovelnose sturgeon and no other target species were captured on set lines during the sturgeon sampling seasons, little can be inferred between shovelnose sturgeon distribution and habitat availability (Table 19).

Community Sampling Season

The community sampling season began on 1 July and continued until the water temperatures dropped below 12.7^{o}C.

Otter Trawl

A total of 899 fish representing 24 species were captured in 12,424 meters of trawling, with a CPUE of 7.24 fish per 100 m trawled (Table 20). Freshwater drum (*Aplodinotus grunniens*) were the most frequently captured of any species with a CPUE of 2.18, while channel catfish were second with a CPUE of 0.95.

Four macrohabitats were sampled during otter trawling: outside bends, inside bends, secondary connected channel-large, and confluences. Outside bends had the highest rate of catch for all macrohabitats (CPUE = 37.17), followed by inside bends with a CPUE of 6.68 (Table 20). Based on available depth, shovelnose sturgeon (x^2 = 22.545, df = 7, P = 0.002) and speckled chubs (x^2 = 21.383, df = 7, P = 0.003) were not distributed randomly (Tables 21). Shovelnose sturgeon selected depths between 3 and 4 m and avoided water deeper 5 m. Speckled chubs selected depths less than 4 m. Based on available bottom velocities, shovelnose sturgeon were not randomly distributed (x^2 = 36.673, df = 4, P = 0.001) selecting bottom velocities between 0.6 and 0.8 mps.

Trammel Net

A total of 311 fish representing 13 species were captured in 12,611 meters of drifted trammel nets, with a CPUE of 2.47 fish per 100 m drifted (Table 22). Shovelnose sturgeon were the most frequently captured of any species with a CPUE of 1.16, while blue suckers were second with a CPUE of 0.90.

Three macrohabitats were sampled during trammel netting: inside bends, secondary connected channel-large, and confluences. Channel borders were the only mesohabitat sampled. Inside bends had the highest catch rate, a CPUE of 2.54, followed by secondary-connected channel large with a CPUE of 1.94 (Table 22). Based on available depth, shovelnose sturgeon (x^2 = 13.102, df = 3, P = 0.004) and blue suckers (x^2 = 18.223, df = 3, P = 0.001) were not distributed randomly (Tables 23). Shovelnose sturgeon and blue suckers selected depths between 1 and 3 m. Based on available bottom velocities, shovelnose sturgeon (x^2 = 19.782, df = 4, P = 0.001) and blue suckers (x^2 = 44.220, df = 4, P = 0.001) were not distributed randomly. Shovelnose sturgeon selected bottom velocities between 0.4 and 0.6 mps and blue sucker selected bottom velocities between 0.2 and 0.6 mps.

Hoop Net

A total of 167 fish representing 16 species were captured in 94 net nights with hoop nets, with a CPUE of 1.78 fish per net (Table 24). Blue suckers were the most frequently captured of any species with a CPUE of 0.46, while flathead catfish (*Pylodictis olivaris*) were second with a CPUE of 0.41.

Four macrohabitats were sampled during hoop netting: outside bends, inside bends, secondary connected channel-large, and confluences. Pools and channel borders were the two mesohabitats sampled during hoop netting. Secondary connected channel large and tributary confluences had the highest macrohabitat catch rate, with a CPUE of 4.00 fish, followed by inside bends with a CPUE of 1.78 (Table 24). Blue suckers were captured more

abundantly in hoop nets during the community sampling seasons than any other target species. Based on available depth, blue suckers were not distributed randomly (x^2 = 37.060, df = 6, P = 0.001) (Tables 25). Blue suckers selected depths between 1 and 2 m.

Seine

Bag seines were used only in the community sampling season. A total of 2,947 fish representing 31 species were captured in 80 seine hauls, with a CPUE of 27.75 fish per 100 m^2 haul (Table 26). Plains minnows (*Hybognathus placitus*) were the most frequently captured of any species with a CPUE of 11.15, while red shiners (Cyprinella lutrensis) were second with a CPUE of 3.39.

Six macrohabitats were sampled: outside bends, inside bends, secondary connected channel-large, tributary mouth-small, tributary mouth-large, and confluences. Only one mesohabitat, bars, were sampled for each macrohabitat while seining. Outside bend bars had the highest rate of catch, a CPUE of 69.86, followed by tributary mouth-large bars with a CPUE of 30.72 (Table 26). Sand shiners and plains minnows were captured more abundantly in seine hauls than other target species. Based on available depth, sand shiners (x^2 = 35.793, df = 6, P = 0.001) and plains minnows (x^2 = 90.346, df = 6, P = 0.001) were not distributed randomly (Tables 27). Sand shiners and plains minnows selected depths between 0.3 and 0.4 m. Based on available bottom velocities, sand shiners (x^2 = 21.764, df = 3, P = 0.001) and plains minnows (x^2 = 65.656, df = 3, P = 0.001) were not distributed randomly. Sand shiners and plains minnows selected bottom velocities between 0.0 and 0.1 mps.

Mini-Fyke Net

Mini-fyke nets were used only in the community sampling season. A total of 1,077 fish representing 32 species were captured in 83 net nights, with a CPUE of 12.98 fish per net (Table 28). Freshwater drum were the most frequently captured of any species with a CPUE of 2.92, while red shiners *(Cyprinella lutrensis*) were second with a CPUE of 2.29.

Six macrohabitats were sampled during mini-fyke netting: outside bends, inside bends, secondary connected channel-large, tributary mouth-small, tributary mouth-large, and confluences. Bars were the only mesohabitat sampled during mini-fyke netting. Tributary mouth-large had the highest catch rate of all macrohabitats, with a CPUE of 16.50, followed by tributary mouth-small with a CPUE of 15.83 (Table 28). Sand shiners were captured more abundantly in mini-fyke nets than any other target species. Because a low quantity of

target species were captured while running mini-fyke nets, little can be inferred between the distribution of target species and habitat availability (Table 29).

Set Line

A total of one fish was captured on 76 hook nights while set lining, a CPUE of 0.01 fish per hook night (Table 30). Three macrohabitats were sampled during set lining: outside bends, inside bends, and tributary confluence. Outside bend was the only macrohabitat where a fish was collected. No target species were collected during the community sampling season while set lining.

Other Results

Catch of target species by gear and mesohabitat were examined. Three pallid sturgeon, two in gill nets and one in an otter trawl, were captured during 2003 sampling. The two pallid sturgeon captured in gill nets were located in pools, while the one captured in the otter trawl was located in the thalweg (Figure 5). Shovelnose sturgeon were most frequently captured using gill nets in pools (Figure 6). Speckled chubs were most frequently captured using otter trawls in channel borders and pools (Figure 7). Sturgeon chubs (*Macrhybopsis gelida*) had the highest catch rate with a single gear type using otter trawls, but had the highest overall mesohabitat catch rate in the thalweg using otter trawls and beam trawls (Figure 8). Sicklefin chubs (*Macrhybopsis meeki*) were most frequently captured using otter trawls in channel borders (Figure 9). Sand shiners had the highest catch rate using bag seines on bars (Figure 10). Plains minnows were only sampled on bars and most frequently using bag seines (Figure 11). Blue suckers were most frequently captured in channel borders, and most frequently caught using trammel nets and hoop nets (Figure 12). Bigmouth buffalo (*Ictiobus cyprinellus*) were most frequently sampled using hoop nets, and were most frequently captured in pools (Figure 13). Sauger (*Stizostedion canadense*) were most frequently sampled on bars using bag seines (Figure 14).

Percent catch of target species by macrohabitat and mesohabitat were examined. During the winter sampling season, all target species were most frequently captured on inside bends (Figure 15). During the sturgeon sampling season, nine of ten target species, including pallid sturgeon were sampled. These nine species were caught in five different macrohabitats and four different mesohabitats (Figure 16, 17). During the community sampling season nine target species, excluding pallid sturgeon, were captured. These nine species were sampled in six different macrohabitats and four different mesohabitats (Figure 18, 19).

Table 8. Catch per unit effort for all species by macrohabitat and mesohabitat for winter gill netting during 2003.

Macrohabitat		Outside Bend		Inside Bend		Confluence		Total		
Mesohabitat		Pool		Pool		Pool		Pool		
Species	Origin	GN81 / GN18	Mean	GN81 / GN18	Mean	GN81 / GN18	Mean	GN81 / GN18	Mean CPUE	N
Lake Sturgeon	Native			0.00 / 0.01	< 0.01			0.00 / 0.01	< 0.01	1
Pallid Sturgeon [T]	Native			0.01 / 0.01	0.01			0.01 / 0.01	0.01	2
Shovelnose Sturgeon [T]	Native	8.00 / 1.00	3.33	13.42 / 10.67	12.13	25.50 / 14.00	17.83	13.55 / 10.41	11.98	2408
Paddlefish	Native	0.00 / 0.25	0.17	0.05 / 0.06	0.05			0.05 / 0.06	0.06	11
Longnose Gar	Native			0.23 / 0.22	0.22			0.22 / 0.20	0.21	42
Shortnsoe Gar	Native			0.19 / 0.11	0.15			0.18 / 0.10	0.14	29
Goldeye	Native	1.00 / 3.25	2.50	1.54 / 0.82	1.20			1.50 / 0.89	1.20	241
Skipjack Herring	Native			0.00 / 0.01	< 0.01			0.00 / 0.01	<0.01	1
Gizzard Shad	Native	0.00 / 0.75	0.50	0.07 / 0.02	0.05			0.07 / 0.05	0.06	12
Grass Carp	Invasive			0.03 / 0.05	0.04			0.03 / 0.04	0.04	7
Common Carp	Invasive			0.10 / 0.08	0.09			0.10 / 0.07	0.09	17
Bighead Carp	Invasive			0.02 / 0.00	0.01			0.02 / 0.00	0.01	2
River Carpsucker	Native			0.04 / 0.05	0.04			0.04 / 0.04	0.04	8
Quillback	Native			0.01 / 0.00	< 0.01			0.01 / 0.00	< 0.01	1
Blue Sucker [T]	Native			0.08 / 0.18	0.13			0.08 / 0.17	0.13	24
Smallmouth Buffalo	Native			0.03 / 0.11	0.02			0.03 / 0.01	0.02	4
Bigmouth Buffalo [T]	Native			0.01 / 0.00	< 0.01			0.01 / 0.00	< 0.01	1
Shorhead Redhorse	Native			0.02 / 0.02	0.02			0.02 / 0.02	0.02	4

Macrohabitat		Outside Bend		Inside Bend		Confluence		Total		
Mesohabitat		Pool		Pool		Pool		Pool		
Species	Origin	GN81 / GN18	Mean	GN81 / GN18	Mean	GN81 / GN18	Mean	GN81 / GN18	Mean CPUE	N
Blue Catfish	Native	0.00 / 0.75	0.50	0.04 / 0.06	0.05			0.04 / 0.08	0.06	12
Channel Catfish	Native			0.37 / 0.30	0.34	0.50 / 1.50	1.17	0.37 / 0.33	0.35	70
Flathead Catfish	Native			0.02 / 0.00	0.01			0.02 / 0.00	0.01	2
Table 8. Continued White Bass	Introduced			0.00 / 0.02	0.01			0.00 / 0.02	0.01	2
Wiper	Introduced			0.02 / 0.00	0.01			0.02 / 0.00	0.01	2
Sauger [T]	Native			0.01 / 0.05	0.03			0.01 / 0.04	0.03	5
Walleye	Native			0.43 / 0.26	0.35			0.41 / 0.24	0.33	66
Freshwater Drum	Native			0.07 / 0.08	0.07			0.07 / 0.07	0.07	14
Number of Fish		18 / 24	21	1681 / 1151	1416	52 / 62	57	1751 / 1237		2988
Effort		2.00 / 4.00	3.00	100.00 / 88.00	94.00	2.00 / 4.00	3.00	104.00 / 96.00		200.00
CPUE		9.00 / 6.00	7.00	16.81 / 13.08	15.06	26.00 / 15.50	19.00	16.84 / 12.89	14.94	

[T] Denotes Target Species

Table 9. Percent catch for target species vs. habitat availability for winter gill netting for segment 9 during 2003.

Depth (m)		1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	8 - 9	9 - 10	10 - 11
Availability		13.0	33.0	26.0	13.0	6.0	4.0	2.0	2.0	0.0	1.0
Species	N										
Pallid Sturgeon	2	50.0	50.0								
Shovelnose Sturgeon	2,408	14.7	33.1	23.8	11.2	8.4	3.9	1.3	2.8		0.9
Blue Sucker	23	13.0	30.4	39.1	17.4						
Bigmouth Buffalo	1		100.0								
Sauger	5	20.0	20.0	20.0		20.0					20.0

Bottom Velocity (mps)		0.0 - 0.2	0.2 - 0.4	0.4 - 0.6	0.6 - 0.8
Availability		26.9	38.5	30.8	3.8
Species	N				
Pallid Sturgeon	2	100.0			
Shovelnose Sturgeon	539	17.5	38.3	43.5	0.7
Blue Sucker	7	12.5	12.5	75.0	
Sauger	1				100.0

Table 10. Catch per unit effort for all species for otter trawling during the sturgeon sampling seasons for segment 9 during 2003.

Macrohabitat	Outside Bend	Inside Bend	Secondary Connected Channel-Large	Trib. Mouth - Large	Confluence	